



## **Stability in Lepidoptera names is not served by reversal to gender agreement a response to Wiemers et al. (2018)**

van Nieukerken, Erik J.; Karsholt, Ole; Hausmann, Axel; Holloway, Jeremy D.; Huemer, Peter; Kitching, Ian J.; Nuss, Matthias; Pohl, Gregory R.; Rajaei, Hossein; Rennwald, Erwin; Rodeland, Jürgen; Rougerie, Rodolphe; Scoble, Malcolm J.; Sinev, Sergey Yu.; Sommerer, Manfred

*Published in:*  
Nota Lepidopterologica

*DOI:*  
[10.3897/nl.42.34187](https://doi.org/10.3897/nl.42.34187)

*Publication date:*  
2019

*Document version*  
Publisher's PDF, also known as Version of record

*Document license:*  
[Unspecified](#)

*Citation for published version (APA):*  
van Nieukerken, E. J., Karsholt, O., Hausmann, A., Holloway, J. D., Huemer, P., Kitching, I. J., Nuss, M., Pohl, G. R., Rajaei, H., Rennwald, E., Rodeland, J., Rougerie, R., Scoble, M. J., Sinev, S. Y., & Sommerer, M. (2019). Stability in Lepidoptera names is not served by reversal to gender agreement: a response to Wiemers et al. (2018). *Nota Lepidopterologica*, 42(1), 101-111. <https://doi.org/10.3897/nl.42.34187>

## Stability in Lepidoptera names is not served by reversal to gender agreement: a response to Wiemers et al. (2018)

ERIK J. VAN NIEUKERKEN<sup>1</sup>, OLE KARSHOLT<sup>2</sup>, AXEL HAUSMANN<sup>3</sup>,  
JEREMY D. HOLLOWAY<sup>4</sup>, PETER HUEMER<sup>5</sup>, IAN J. KITCHING<sup>6</sup>, MATTHIAS NUSS<sup>7</sup>,  
GREGORY R. POHL<sup>8</sup>, HOSSEIN RAJAEI<sup>9</sup>, ERWIN RENNWALD<sup>10</sup>, JÜRGEN RODELAND<sup>11</sup>,  
RODOLPHE ROUGERIE<sup>12</sup>, MALCOLM J. SCOBLE<sup>13</sup>, SERGEY YU. SINEV<sup>14</sup>,  
MANFRED SOMMERER<sup>15</sup>

1 Naturalis Biodiversity Center, PO Box 9557, NL-2300 RA Leiden, The Netherlands; [nieukerken@naturalis.nl](mailto:nieukerken@naturalis.nl)

2 Zoological Museum, Natural History Museum of Denmark, Universitetsparken 15, DK-2100 Copenhagen, Denmark; [okarsholt@snm.ku.dk](mailto:okarsholt@snm.ku.dk)

3 Zoologische Staatssammlung, Münchhausenstr. 21, 81247 Munich, Germany; [hausmann.a@snsb.de](mailto:hausmann.a@snsb.de)

4 Department of Life Sciences, Natural History Museum, Cromwell Road, London, SW7 5BD, UK; [mothol@btinternet.com](mailto:mothol@btinternet.com)

5 Tiroler Landesmuseen Betriebsgesellschaft m.b.H., Naturwissenschaftliche Sammlungen, Sammlungs- und Forschungszentrum, Krajnc-Straße 1, AT-6060 Hall, Austria; [p.huemer@tiroler-landesmuseen.at](mailto:p.huemer@tiroler-landesmuseen.at)

6 Department of Life Sciences, Natural History Museum, Cromwell Road, London, SW7 5BD, UK; [i.kitching@nhm.ac.uk](mailto:i.kitching@nhm.ac.uk)

7 Museum of Zoology, Königsbrücker Landstr. 159, 01109 Dresden, Germany; [matthias.nuss@senckenberg.de](mailto:matthias.nuss@senckenberg.de)

8 Natural Resources Canada, Canadian Forest Service, 5320 - 122 St., Edmonton, AB, T6H 3S5 Canada; [micromothman@gmail.com](mailto:micromothman@gmail.com)

9 Department of Entomology, State Museum of Natural History Stuttgart, Rosenstein 1, D-70191 Stuttgart, Germany; [hossein.rajaei@smns-bw.de](mailto:hossein.rajaei@smns-bw.de)

10 Lepiforum e.V., Mozartstr. 8, D-76287 Rheinstetten, Germany; [erwin@rennwald-biol.de](mailto:erwin@rennwald-biol.de)

11 Lepiforum e.V., Uwe-Beyer-Str. 67a, D-55128 Mainz, Germany; [juergen.mobil@rodeland.de](mailto:juergen.mobil@rodeland.de)

12 Institut de Systématique, Evolution, Biodiversité (ISYEB), Muséum national d'Histoire naturelle, CNRS, Sorbonne Université, EPHE, Université des Antilles, 45 rue Buffon CP50, 75005 Paris, France; [rrougerie@mnhn.fr](mailto:rrougerie@mnhn.fr)

13 Department of Life Sciences, Natural History Museum, Cromwell Road, London, SW7 5BD, UK; [M.Scoble@nhm.ac.uk](mailto:M.Scoble@nhm.ac.uk)

14 Zoological Institute, Russian Academy of Sciences, Universitetskaya emb. 1, 199034 St. Petersburg, Russia; [sinev@zin.ru](mailto:sinev@zin.ru)

15 Volpinistr. 72, D-80638 München, Germany; [sommerer.manfred@t-online.de](mailto:sommerer.manfred@t-online.de)

<http://zoobank.org/30E003A7-61FE-45DA-A5AF-46403B59DB43>

Received 28 February 2019; accepted 1 May 2019; published: 26 June 2019

Subject Editor: David C. Lees

In a recent paper in ZooKeys, Wiemers et al. (2018) provided an updated list of European butterfly names. In this list the authors follow gender agreement for species names, when interpreted as adjectival in derivation, in contrast to the common practice among most lepidopterists. Here we comment on this aspect of the paper, and voice our concern that this reversal does not benefit the stability of Lepidoptera names and is, indeed, inimical to their stability.

Modern zoological science needs the communities of taxonomists and users to agree on the names that are used to communicate information about the taxa we study and cherish. In this age,

such collegiate acceptance is more important than ever, given that the number of users of scientific names has increased enormously. Agreement is particularly important when considering the numerous online databases, observation sites, Wikipedia, etc. Several global and local initiatives over the last several decades have begun to compile authoritative lists of taxonomic names to serve the community and build towards a greater stability, including Species 2000 / Catalogue of Life (Roskov et al. 2018; Roskov et al. 2019), Global Biodiversity Information Facility (GBIF Secretariat 2019) and Fauna Europaea (de Jong et al. 2014; Fauna Europaea 2017).

Unfortunately, the current (and likely future) funding situation for most of these projects is poor, to say the least, and populating these databases relies heavily on a diminishing number of taxonomists, who rarely receive recognition for their work. The Fauna Europaea database, which is of special importance as Europe's main zoological taxonomic index, has suffered particularly, being an EU-supported project that was only funded by the European Commission between 2000 and 2004. Subsequently, updating was carried out at the Zoological Museum of Amsterdam (de Jong et al. 2014), first under the umbrella of the PESI project (PESI 2011; de Jong et al. 2015), then later without funding, until the Amsterdam museum was merged with Naturalis Biodiversity Center in Leiden in 2011. Since then, the Fauna Europaea database has been run by the Museum für Naturkunde, Leibniz-Institute for Research on Evolution and Biodiversity, Berlin, Germany. Recently, however, updating has come to a stand-still, very much to the frustration both of taxonomists who wish to update their lists and of users who need an up-to-date and authoritative nomenclature.

Given these circumstances, we enthusiastically applaud the initiative that several specialists of European butterflies have taken separately to publish an update for butterflies (superfamily Papilionoidea) in an open access journal, to produce a new list for the use of the scientific community (Wiemers et al. 2018).

## Gender agreement or not

The Preamble of the International Code of Zoological Nomenclature (*the Code*) states: *The objects of the Code are to promote stability and universality in the scientific names of animals and to ensure that the name of each taxon is unique and distinct* (International Commission on Zoological Nomenclature 1999).

It is generally accepted (though perhaps not always welcomed) that names of taxa change as a result of new taxonomic and phylogenetic research. Such changes are an increasingly frequent occurrence, especially when new data sources (such as nucleotide sequences, from DNA barcodes to entire genomes) are brought to bear on taxonomic, evolutionary and phylogenetic problems. We fully support such changes when they are implemented as a result of rigorous scientific study and have been accepted by the scientific community. Other changes, by contrast, are nomenclatural in nature and based on the application of rules from the international codes of nomenclature. Some follow from research into original descriptions, types, etc., often depending on new interpretations of old literature, while others are purely linguistic, and these usually cause the most controversy. In this paper, we discuss one of these issues – gender agreement – which, arguably, jeopardizes the very aim of name stability in Linnaean nomenclature.

The major problem that this new list of European butterflies (Wiemers et al. 2018) creates might seem trivial, but in its wider context threatens the stability of thousands of names of moths and butterflies globally, namely, the question as to whether a species name (or epitheton), when

interpreted as adjectival in derivation, should agree in grammatical gender with the genus name or not. Although such agreement is still formally required by *the Code*, most lepidopterists ceased following the rule many years ago (e.g. Scoble 1999). The justification for ignoring the rule was described in detail and defended by Sommerer (2002), who argued strongly that the original spelling (orthography) be used. This recommendation was adopted at the General Meeting of the Societas Europaea Lepidopterologica (SEL) in a resolution proposed at the 13<sup>th</sup> European Congress of Lepidopterology in Korsør (Denmark) on June 4, 2002 (the text of which immediately follows the paper by Sommerer 2002). Welter-Schultes (2012: 92) in his nomenclature textbook published by GBIF, also described “the Lepidoptera model”, where gender agreement never gained a strong position, and suggests (page 93): *In such a situation it can only be recommended to maintain the names in the incorrect forms as they are, and not to change them.*

Since 2002, but also earlier, almost all major Lepidoptera databases and catalogues have followed this principle of original orthography (summarised in Table 1). The managers of Fauna Europaea initially opposed the position (Sommerer 2002), but finally adopted it as a general principle for Lepidoptera in the first update and published it as such in the broad description of the project (de Jong et al. 2014). Apart from the catalogues listed in Table 1, major modern handbook series, such as “Microlepidoptera of Europe”, “Noctuidae Europaeae”, “Geometrid Moths of Europe”, “The Moths and Butterflies of Great Britain and Ireland”, “Moths of Borneo”, “Heterocera Sumatrana”, “Moths of Thailand” and “Monographs of Australian Lepidoptera”, all adhere to the use of original spellings. We could only find some six recent national catalogues and two global catalogues that follow the *Code* strictly (Table 1), in addition to several checklists where a mixture of correct gender agreement and original spelling was applied, a further indication that adhering to this principle is not easy, even for those familiar with the complexities of Latin and Greek grammar.

The stance taken by so many lepidopterists has been adopted by some other zoologists. For example, Welter-Schultes (2012), although providing rules on how to apply gender agreement or avoid its necessity, concluded (page 87) “A gender is nothing useful”. In ornithology, too, a discussion is taking place as to whether gender agreement is of any use (Schodde and Bock 2016; 2017). To quote from the first of these papers (page 167): *The second point is the sheer mind-numbing, time-consuming complexity of determining gender for species-group names in zoological nomenclature. This is also the single greatest source of regulation-driven change in the spelling of species-group names, often disruptively so.*

These are precisely the reasons why the vast majority of lepidopterists long ago decided to use original spellings. To apply gender agreement correctly, not only is it necessary to determine the correct gender of the generic name, which is far from straightforward in many cases, but often it is even more difficult to ascertain whether the species epithet is an adjective or participle, which both can be declined, or a (composite) noun. The number of errors caused by this latter problem is huge, which is understandable both because most modern taxonomists have no training in Latin or Greek, and because many names can be easily interpreted in different ways. Such difficulties are particularly prominent in Lepidoptera, given that many artificial names sometimes are not Latin adjectives but rather composite nouns, e.g. those ending in the suffixes -ella, -ellus, -ellum (Huemer 1988). The name *Erebia aethiopellus* (Hoffmansegg, 1806), among the names discussed here, belongs also in this category (Table 2). Certainly, in the current age of diminishing resources for taxonomy (both financial and human), and given the great need for taxonomy at a time of catastrophic biodiversity loss, it is indefensible to spend time on these kinds of disputes instead of

**Table 1.** Survey of recent national, regional and global taxonomic catalogues of Lepidoptera, with indication of whether gender agreement is observed or not. When authors have explained their position on this matter, the page number for this explanation or statement is provided.

Area	Reference	Page of statement	Gender agreement?
<b>Local catalogues</b>			
<b>Europe</b>			
Europe	Karsholt and Razowski (1996)	12	No
Europe	Karsholt and van Nieukerken (2017)	see de Jong et al. (2014: 7)	No
Europe	Lepiforum e.V. (2008–2019)	Glossar	No
Austria	Huemer (2013)	–	No
Belgium	De Prins (2016)	8	No
Czech Republic	Laštůvka and Liška (2011)	–	No
Denmark	Karsholt and Stadel Nielsen (2013)	5	No
Estonia	Jürivete and Õunap (2008)	–	Yes <sup>1</sup>
Finland	Kullberg et al. (2002)	–	Yes <sup>1</sup>
France	Leraut (1997)	22, 48, etc.	No
Germany	Gaedike et al. (2017)	–	No
Hungary (micromoths)	Pastorális and Buschmann (2018)	–	No
Latvia	Savenkov and Šulcs (2010)	–	No
Lithuania	Ivinskis (2004)	–	No
Netherlands	Kuchlein and de Vos (1999)	6	No
Nordic-Baltic Europe	Aarvik et al. (2017)	3	No
Norway	Aarvik et al. (2000)	–	No
Poland	Buszko and Nowacki (2017)	–	No
Portugal	Corley (2015)	53	No
Romania	Rákosy et al. (2003)	–	Mixed
Russia	Sinev (2008)	–	No
Serbia (micromoths)	Jakšić (2016)	–	No
Slovakia	Pastorális et al. (2013)	–	No
Slovenia	Lesar and Govedic (2010)	–	No
Spain	Vives Moreno (2014)	–	Mixed
Sweden	Bengtsson et al. (2016)	7	Yes <sup>1</sup>
Switzerland	SwissLepTeam (2010)	–	No
United Kingdom	Agassiz et al. (2013)	2	No
<b>Other continents</b>			
North America	Pohl et al. (2016)	19	No
Canada	Pohl et al. (2018)	23	No
Afrotropics	De Prins and De Prins (2018b)	–	No
Southern Africa	Vári et al. (2002)	–	Mixed
Australia	Nielsen et al. (1996)	2	No
New Zealand	Dugdale (1988)	–	Yes
Borneo	Holloway (2011)	4	No
China	Hua (2005)	–	Mixed
Japan	Kishida (2011a, b), Hirowatari et al. (2013), Nasu et al. (2013)	–	Mixed
Russia Far East	Lelej (2016)	–	No
Taiwan	Heppner and Inoue (1992)	xx	Mixed <sup>2</sup>
Neotropics	Heppner (1984)	xv	No

Area	Reference	Page of statement	Gender agreement?
<b>Global catalogues</b>			
Global LepIndex	Beccaloni et al. (2005)	–	No
Catalogue of Life	Roskov et al. (2018); Roskov et al. (2019)	–	No
Blastobasidae	Sinev (2014)	–	No
Bombycoidea	Kitching et al. (2018)	4	No
Coleophoridae	Baldizzone et al. (2006)	–	N/A <sup>3</sup>
Cosmopterigidae	Sinev (2002)	–	No
Cossidae	Yakovlev (2011)	–	Yes
Geometridae	Scoble (1999)	xxii	No
Gracillariidae	De Prins and De Prins (2018a)	–	No
Hepialidae	Nielsen et al. (2000)	827	No
Nepticuloidea	van Nieukerken et al. (2016)	90	No
Noctuoidea	Poole (1989)	–	No
Notodontidae	Schintlmeister (2013)	10	No
Papilionidae, Pieridae	Häuser et al. (2012)	–	No
Psychidae	Sobczyk (2011)	14	No
Pterophoridae	Gielis (2003)	6	No
Pyraloidea	Nuss et al. (2003–2017)	introduction	No
Scythrididae	Passerin d’Entreves and Roggero (2007)	–	N/A <sup>3</sup>
Sesiidae	Pühringer and Kallies (2004, 2017)	–	Yes
Stathmopodidae	Sinev (2015)	–	No
Tineidae	Robinson (2019)	–	No
Tortricidae	Gilligan et al. (2018)	–	No
Yponomeutoidea	Lewis and Sohn (2015)	12	No

Notes:

1 Lists of Estonia, Finland and Sweden, three of the four European lists with gender agreement, are superseded by the Nordic-Baltic List with original spelling.

2 Introduction states to use original spelling, but in fact it is a mixture.

3 In this family all generic names are feminine, gender agreement is not relevant.

**Table 2.** Recommended correct names - with original spelling of epithet - of 14 European butterfly species for which names in Wiemers et al. (2018) were reversed through applying gender agreement.

<i>Agriades pyrenaica</i> (Boisduval, 1840)
<i>Carcharodus tripolina</i> (Verity, 1925)
<i>Colias croceus</i> (Geoffroy, 1785)
<i>Cupido decolorata</i> (Staudinger, 1886)
<i>Erebia aethiopellus</i> (Hoffmansegg, 1806)
<i>Erebia alberganus</i> (Prunner, 1798)
<i>Erebia montanus</i> (Prunner, 1798)
<i>Erebia stirijs</i> (Godart, 1824)
<i>Hipparchia azorinus</i> (Strecker, 1899)
<i>Hyponphele lupinus</i> (Costa, 1836)
<i>Kretania hespericus</i> (Rambur, 1839)
<i>Lycaena dimorphus</i> (Staudinger, 1881)
<i>Lycaena ottomanus</i> (Lefébvre, 1831)
<i>Tarucus balkanica</i> (Freyer, 1844)

doing real taxonomy, as it requires delving into ancient Latin and Greek linguistics and grammar that few specialists understand. In contrast, adopting original spellings means they have only to be checked once, which is a relatively easy process nowadays, especially as most databases include original names anyway, and as most old publications have become easily accessible through initiatives such as the Biodiversity Heritage Library (2005–2019).

Although we strongly adhere to the objects of the *Code* as expressed in our quote of its Preamble above, we consider that Article 34.2, which deals with gender agreement between genus and species names, contradicts that part of the Preamble.

## Conclusion

Given that the overwhelming majority of authors of publications on Lepidoptera use original spelling rather than gender agreement, we conclude that Wiemers *et al.* (2018) did a disservice to nomenclatural stability as well as to the users of butterfly names, who are generally unaware of the intricacies of zoological nomenclature. Clearly, Wiemers *et al.* (2018: 15) were conscious of the practice adopted by most lepidopterists and the reasons for it as shown in this quote:

*This includes the controversial article 34.2, which mandates that »the ending of a Latin or Latinised adjectival or participial species-group name must agree in gender with the generic name with which it is at any time combined«. Due to its linguistic complexity, this rule has led to many wrong or ambiguous decisions and causes additional instability of nomenclature each time a species name is transferred to another genus. Therefore a majority of lepidopterists, including the group editors of Fauna Europaea, have decided to ignore this rule and use the original spelling instead (de Jong *et al.* 2014).*

Yet, curiously, Wiemers *et al.* (2018) gave no reasons for not following the “original spelling” convention that has become common practice among their lepidopterist colleagues. The published list (Wiemers *et al.* 2018) was presented as an update for Fauna Europaea, which, as noted above, has expressly adopted original spellings for Lepidoptera. Two of us (OK, EvN), as Group coordinators for Lepidoptera in Fauna Europaea, made critical comments on the draft list, and objected to the use of gender agreement at the time (e-mails late 2016).

We strongly recommend that users of the list ignore the changes to the 14 names affected, which are published by Wiemers *et al.* (2018) in table 7, page 7, and recommend that the names in the right hand column be used instead. We provide in this response these names for convenience (Table 2), and recommend most strongly that these original spellings are adopted by all users for purpose of nomenclatural stability.

Continuation of the current situation, in which workers on a particular group of animals elect to ignore a rule of the *Code*, will undoubtedly lead to new discussions in future. Thus, we also plead for a consistent change in the next version of the *Code* to allow for greater stability in the endings of names in general and for Lepidoptera in particular. Suggestions for abandoning gender agreement have been proposed before. One option, perhaps, could be to make a special dispensation to exempt Lepidoptera from the practice of following gender agreement given that this has led to relative stability of global Lepidoptera names (Welter-Schultes 2012: 92 and personal communication). However, we are aware that such special pleading could easily open the floodgates to numerous bespoke claims in other groups in other areas of nomenclature, leading to increased instability. The simplest and most stabilizing way forward would clearly be to do away with gender agreement altogether.



## Acknowledgements

For constructive comments and discussion we are grateful to Thomas Pape (Copenhagen) and Francisco Welter-Schultes (Goettingen). We thank Alberto Zilli and David Lees for constructive remarks on the first version. IJK was supported by NERC grant number NE/P003915/1.

## References

- Aarvik L, Berggren K, Hansen LO (2000) *Catalogus Lepidopterorum Norvegiae*. Zoologisk Museum, Oslo, 192 pp.
- Aarvik L, Bengtsson BÅ, Elven H, Ivinskis P, Jürivete U, Karsholt O, Mutanen M, Savenkov N (2017) Nordic-Baltic Checklist of Lepidoptera. *Norwegian Journal of Entomology*. Supplement 3: 1–236. [http://www.entomologi.no/journals/nje/Suppl/Aarvik\\_et\\_al\\_2017\\_Nordic-Baltic\\_Checklist\\_of\\_Lepidoptera.pdf](http://www.entomologi.no/journals/nje/Suppl/Aarvik_et_al_2017_Nordic-Baltic_Checklist_of_Lepidoptera.pdf).
- Agassiz DJL, Beavan SD, Heckford RJ (Eds) (2013) *A checklist of the Lepidoptera of the British Isles. Handbooks for the Identification of British Insects*, Royal Entomological Society of London, London, iv + 206 pp.
- Baldizzone G, Wolf H van der, Landry J-F (2006) *Coleophoridae, Coleophorinae (Lepidoptera)*. *World Catalogue of Insects* 8: 1–215.
- Beccaloni G, Scoble M, Robinson G, Pitkin B (2005) *The Global Lepidoptera names index*. Natural History Museum. <http://www.nhm.ac.uk/our-science/data/lepindex/index.html>
- Bengtsson BÅ, Gustafsson B, Palmqvist G (2016) *Katalog över svenska fjärilar*. *Catalogue of the Lepidoptera of Sweden*. Entomologiska Föreningen, Stockholm, 328 pp.
- Biodiversity Heritage Library (2005–2019) BHL, Biodiversity Heritage Library. Inspiring discovery through free access to biodiversity knowledge. <https://www.biodiversitylibrary.org/>
- Buszko J, Nowacki J (2017) *A distributional checklist of the Lepidoptera of Poland*. *Polish Entomological Monographs* 13: 1–222.
- Corley MFV (2015) *Lepidoptera of Continental Portugal: a fully revised list*. Corley, Faringdon, vi + 282 pp.
- De Prins, J, De Prins, W (2018a) *Global Taxonomic Database of Gracillariidae (Lepidoptera)*. Belgian Biodiversity Platform. <http://www.gracillariidae.net/>
- De Prins, J, De Prins, W (2018b) *Afromoths*, online database of Afrotropical moth species (Lepidoptera). Belgian Biodiversity Platform. <http://www.afromoths.net/>
- De Prins, W (2016) *Catalogus van de Belgische Lepidoptera*. *Catalogue of the Lepidoptera of Belgium*. Entomobrochure 9: 1–279. [http://www.phegea.org/Documents/CatalogueBelgianLepidoptera\\_2016.pdf](http://www.phegea.org/Documents/CatalogueBelgianLepidoptera_2016.pdf).
- Dugdale, JS (1988) *Lepidoptera: annotated catalogue, and keys to family-group taxa*. *Fauna of New Zealand* 14: 1–262. <http://www.biotaxa.org/fnz/article/view/1754>
- Fauna Europaea (2017) *Fauna Europaea*, all European Animal Species online, version 2017.06. *Fauna Europaea*. <https://fauna-eu.org/>
- Gaedike, R, Nuss, M, Steiner, A, Trusch, R (2017) *Verzeichnis der Schmetterlinge Deutschlands (Lepidoptera)*. 2. überarbeitete Auflage. *Entomologische Nachrichten und Berichte Beiheft* 21: 1–362.
- GBIF Secretariat (2019) *Global Biodiversity Information Facility*, Free and open access to biodiversity data. GBIF. <http://www.gbif.org/>
- Gielis C (2003) *Pterophoroidea & Alucitoidea (Lepidoptera)*. Apollo Books, Stenstrup, *World Catalogue of Insects* 4: 1–198.
- Gilligan TM, Baixeras J, Brown JW (2018) *T@rts*, Online World Catalogue of the Tortricidae (Version 4.0). Tortricid.net. <http://www.tortricid.net/catalogue.asp>
- Häuser CL, Holstein J, Steiner A (2012) *The Global Butterfly Information System*. Museum für Naturkunde. <http://www.globis.insects-online.de>



- Heppner JB (Ed.) (1984) Checklist 1: Micropterigoidea-Immoidea. Atlas of Neotropical Lepidoptera 1, W. Junk, The Hague etc., xxvii + 112 pp.
- Heppner JB, Inoue H (1992) Lepidoptera of Taiwan. Volume 1. Part 2: checklist. Scientific Publishers Inc. Gainesville, Florida, xlix + 276 pp.
- Hirowatari T, Nasu Y, Sakamaki Y, Kishida Y (Eds) (2013) Nihon-san garui hyojun zukan. The standard of moths in Japan 3. Zygaenidae, Sesiidae, Limacodidae, etc. Gakken Kyoiku Shuppan, Tokyo, 359 pp.
- Holloway JD (2011) The Moths of Borneo: Families Phaudidae, Himantopteridae and Zygaenidae; revised and annotated checklist. Malayan Nature Journal 63: 1–548.
- Hua Li-Zheng (2005) List of Chinese Insects, Vol. 3. Sun Yat-sen University, Guangzhou, 595 pp.
- Huemer P (1988) A taxonomic revision of *Caryocolum* (Lepidoptera: Gelechiidae). Bulletin of the British Museum (Natural History). Entomology 57: 439–571. <https://www.biodiversitylibrary.org/part/78676>
- Huemer P (2013) Die Schmetterlinge Österreichs (Lepidoptera). Systematische und faunistische Checkliste. Tiroler Landesmuseum Ferdinandeum, Innsbruck, StudioHefte 12: 1–304 pp.
- International Commission on Zoological Nomenclature (1999) International Code of Zoological Nomenclature. Fourth edition. Adopted by the International Union of Biological Sciences. The International Trust for Zoological Nomenclature, London, xxix + 306 pp. <http://iczn.org/code>.
- Ivinskis P (2004) Lepidoptera of Lithuania. Annotated catalogue. Lietuvos drugiai (Lepidoptera). Katalogas. Vilniaus Universiteto Ekologijos Institutas, Vilnius, 379 pp.
- Jakšić P (2016) Tentative check list of Serbian Microlepidoptera. Ecologica Montenegrina 7: 33–258. <https://www.biotaxa.org/em/article/view/21598/20703>
- Jong Y de, Verbeek M, Michelsen V, Bjørn PdP, Los W, Steeman F, Bailly N, Basire C, Chylarecki P, Stloukal E, Hagedorn G, Wetzel FT, Glöckler F, Kroupa A, Korb G, Hoffmann A, Häuser C, Kohlbecker A, Müller A, Güntsch A, Stoev P, Penev L (2014) Fauna Europaea – all European animal species on the web. Biodiversity Data Journal 2: e4034. <https://doi.org/10.3897/BDJ.2.e4034>
- Jong Y de, Kouwenberg J, Boumans L, Hussey C, Hyam R, Nicolson N, Kirk P, Paton A, Michel E, Guiry MD, Boegh PS, Pedersen HÆ, Enghoff H, Raab-Straube Ev, Güntsch A, Geoffroy M, Müller A, Kohlbecker A, Berendsohn W, Appeltans W, Arvanitidis C, Vanhoorne B, Declerck J, Vandepitte L, Hernandez F, Nash R, Costello MJ, Ouvrard D, Bezard-Falgas P, Bourgoin T, Wetzel FT, Glöckler F, Korb G, Ring C, Hagedorn G, Häuser C, Aktaş N, Asan A, Ardelean A, Borges PAV, Dhora D, Khachatryan H, Malicky M, Ibrahimov S, Tuzikov A, De Wever A, Moncheva S, Spassov N, Chobot K, Popov A, Boršić I, Sfenthourakis S, Kõljalg U, Uotila P, Olivier G, Dauvin J-C, Tarkhnishvili D, Chaladze G, Tuerkay M, Legakis A, Peregovits L, Gudmundsson G, Ólafsson E, Lysaght L, Galil BS, Raimondo FM, Domina G, Stoch F, Minelli A, Spungis V, Budrys E, Olenin S, Turpel A, Walisch T, Krpach V, Gambin MT, Ungureanu L, Karaman G, Kleukers RMJC, Stur E, Aagaard K, Valland N, Moen TL, Bogdanowicz W, Tykarski P, Węśławski JM, Kędra M, Martins AM de Frias, Abreu AD, Silva R, Medvedev S, Ryss A, Šimić S, Marhold K, Stloukal E, Tome D, Ramos MA, Valdés B, Pina F, Kullander S, Telenius A, Gonseth Y, Tschudin P, Sergeyeva O, Vladymyrov V, Rizun VB, Raper C, Lear D, Stoev P, Penev L, Rubio AC, Backeljau T, Saarenmaa H, Ulenberg S (2015) PESI - a taxonomic backbone for Europe. Biodiversity Data Journal 3: e5848. <https://doi.org/10.3897/BDJ.3.e5848>
- Jürivete U, Õunap E (2008) Eesti Liblikad, katalog. Estonian Lepidoptera, catalogue. Estonian Lepidopterists' Society, Tallinn, 175 pp.
- Karsholt O, Razowski J (Eds) (1996) The Lepidoptera of Europe. A distributional checklist. Apollo Books, Stenstrup, 380 pp. + CD-ROM.
- Karsholt O, Nieukerken EJ van (Eds) (2017) Fauna Europaea: Lepidoptera. Fauna Europaea version 2017.06. Fauna Europaea. <https://fauna-eu.org/>
- Karsholt O, Stadel Nielsen P (2013) Revideret fortegnelse over Danmarks Sommerfugle. Revised checklist of the Lepidoptera of Denmark. Lepidopterologisk Forening, København, 120 pp.

- Kishida Y (Ed.) (2011a) *Nihon-san garui hyojun zukan*. The standard of moths in Japan 1. Callidulidae, Epicopeidae, Drepanidae, Uraniidae, Geometridae, Lasiocampidae, Bombycidae, Saturniidae, Sphingidae. Gakken Kyoiku Shuppan, Tokyo, 352 pp.
- Kishida Y (Ed.) (2011b) *Nihon-san garui hyojun zukan*. The standard of moths in Japan 2. Notodontidae, Lymantriidae, Arctiidae, Aganaiidae, Micronoctuidae, Nolidae, Noctuidae. Gakken Kyoiku Shuppan, Tokyo, 416 pp.
- Kitching IJ, Rougerie R, Zwick A, Hamilton CA, St Laurent RA, Naumann S, Ballesteros Mejia L, Kawahara AY (2018) A global checklist of the Bombycoidea (Insecta: Lepidoptera). *Biodiversity Data Journal* 6: e22236. <https://doi.org/10.3897/BDJ.6.e22236>
- Kuchlein JH, Vos R de (1999) *Geannoteerde naamlijst van de Nederlandse vlinders* [Annotated checklist of the Dutch Lepidoptera]. Backhuys, Leiden, 302 pp.
- Kullberg J, Albrecht A, Kaila L, Varis V (2002) Checklist of Finnish Lepidoptera. *Suomen perhosten luettelo*. Sahlbergia 6: 45–190.
- Laštůvka Z, Liška J (2011) *Komentovaný seznam motýlů České republiky*. Annotated checklist of moths and butterflies of the Czech Republic (Insecta: Lepidoptera). Biocont Laboratory, Brno, 146 pp. [https://www.researchgate.net/publication/310774240\\_Annotated\\_checklist\\_of\\_moths\\_and\\_butterflies\\_of\\_the\\_Czech\\_Republic](https://www.researchgate.net/publication/310774240_Annotated_checklist_of_moths_and_butterflies_of_the_Czech_Republic)
- Lelej AS (Ed.) (2016) *Annotirovannyi Katalog Nasekomykh Dal'nego Vostoka Rossii*. Tom. II, Lepidoptera - Cheshuekrylye. Annotated catalogue of the insects of Russian Far East. Volume II. Lepidoptera. Dal'nauka, Vladivostok, 812 pp.
- Lepiforum e.V. (2008–2019) *Bestimmungshilfe für die in Europa nachgewiesenen Schmetterlingsarten*. Lepiforum e.V. [http://www.lepiforum.de/lepiwiki.pl?Schmetterlingsfamilien\\_Europa](http://www.lepiforum.de/lepiwiki.pl?Schmetterlingsfamilien_Europa)
- Leraut P (1997) *Liste systématique et synonymique des Lépidoptères de France, Belgique et Corse* (deuxième édition). Supplément à Alexanor, Paris, 526 pp.
- Lesar T, Govedic M (2010) Check list of Slovenian Microlepidoptera. *Natura Sloveniae* 12: 35–125. [http://web.bf.uni-lj.si/bi/NATURA-SLOVENIAE/pdf/NatSlo\\_12\\_1\\_3.pdf](http://web.bf.uni-lj.si/bi/NATURA-SLOVENIAE/pdf/NatSlo_12_1_3.pdf)
- Lewis JA, Sohn J-C (2015) Lepidoptera: Yponomeutoidea I (Argyresthiidae, Attevidae, Praydidae, Scythropiidae, and Yponomeutidae). Brill, Leiden, *World Catalogue of Insects* 12: xxiv + 253 pp.
- Nasu Y, Hirowatari T, Kishida Y (Eds) (2013) *Nihon-san garui hyojun zukan*. The standard of moths in Japan 4. Tortricidae, Pyralidae, Gracillariidae etc. Gakken Kyoiku Shuppan, Tokyo, 552 pp.
- Nielsen ES, Edwards ED, Rangsi TV (Eds) (1996) *Checklist of the Lepidoptera of Australia*. CSIRO, Canberra, xiv + 529 pp.
- Nielsen ES, Robinson GS, Wagner DL (2000) Ghost-moths of the world: a global inventory and bibliography of the Exoporia (Mnesarchaeoidea and Hepialoidea) (Lepidoptera). *Journal of Natural History* 34: 823–878. <https://doi.org/10.1080/002229300299282>
- Nieukerken, EJ van, Doorenweerd C, Hoare RJB, Davis DR (2016) Revised classification and catalogue of global Nepticulidae and Opostegidae (Lepidoptera: Nepticuloidea). *ZooKeys* 628: 65–246. <https://doi.org/10.3897/zookeys.628.9799>
- Nuss M, Landry B, Mally R, Vegliante F, Tränkner A, Bauer F, Hayden J, Segerer A, Schouten R, Li H, Trofimova T, Solis MA, De Prins J, Speidel W (2003–2017) *GlobiZ: Global Information System on Pyraloidea*. Senckenberg Collection of Natural History, Museum of Zoology, Dresden (Germany). <http://www.pyraloidea.org/>
- Passerin d'Entreves P, Roggero A (2007) Gelechioidea: Scythrididae. *Lepidopterorum catalogus* (new series) 3: i–xiv, 1–85.
- Pastoralis G, Buschmann F (2018) *A Magyarországon előforduló molylepke-fajok névjegyzéke*, 2018. Checklist of the Hungarian micro-moths, 2018 (Lepidoptera). *microlepidoptera.hu* 14: 77–258. <https://doi.org/10.24386/Microlep.2018.14.77>

- Pastoralis G, Kalivoda H, Panigaj L (2013) Zoznam motýľov (Lepidoptera) zistených na Slovensku. Checklist of Lepidoptera recorded in Slovakia. Folia faunistica Slovaca 18: 101–232. <http://www.ffs.sk/18-2013/15-pastoralis-et-al>
- PESI (2011) A Pan-European Species directories Infrastructure. <http://www.eu-nomen.eu/pesi/>
- Pohl GR, Patterson B, Pelham JP (2016) Annotated taxonomic checklist of the Lepidoptera of North America, North of Mexico. Working paper published online by the authors at ResearchGate.net, 766 pp. [https://www.researchgate.net/publication/302570819\\_Annotated\\_taxonomic\\_checklist\\_of\\_the\\_Lepidoptera\\_of\\_North\\_America\\_North\\_of\\_Mexico](https://www.researchgate.net/publication/302570819_Annotated_taxonomic_checklist_of_the_Lepidoptera_of_North_America_North_of_Mexico)
- Pohl GR, Landry J-F, Schmidt BC, Lafontaine JD, Troubridge JT, Macaulay AD, Nieukerken EJ van, De-Waard JR, Dombroskie JJ, Klymko J, Nazari V, Stead K (2018) Annotated checklist of the moths and butterflies (Lepidoptera) of Canada and Alaska. Pensoft Publishers, Sofia, 580 pp. <https://ebooks.pensoft.net/book/13218/annotated-checklist-of-the-moths-and-butterflies-lepidoptera-of-canada-and-alaska>
- Poole RW (1989) Noctuidae, 3 volumes. Lepidopterorum catalogus (new series), xii + 1314 pp.
- Pühringer F, Kallies A (2004) Provisional checklist of the Sesiidae of the world (Lepidoptera: Ditrysia). Mitteilungen der Entomologischen Arbeitsgemeinschaft Salzkammergut 4: 1–85. [http://www.sesiidae.net/literature/Mitteilungen\\_2004\\_001-085.pdf](http://www.sesiidae.net/literature/Mitteilungen_2004_001-085.pdf)
- Pühringer F, Kallies A (2017) Checklist of the Sesiidae of the world (Lepidoptera: Ditrysia). <http://www.sesiidae.net/Checklist.htm>
- Rákossy L, Goia M, Kovács Z (2003) Catalogul Lepidopterelor României. Verzeichnis der Schmetterlinge Rumâniens. Societatea Lepidopterologica Romana, Cluj-Napoca, 446 pp.
- Robinson GS (2019) Global taxonomic database of Tineidae (Lepidoptera), version 9.0. Species 2000 & ITIS Catalogue of Life 2016. <http://www.catalogueoflife.org/col/details/database/id/31>
- Roskov Y, Abucay L, Orrell T, Nicolson D, Bailly N, Kirk P, Bourgoin T, DeWalt RE, Decock W, De Wever A, Nieukerken E van, Zarucchi J, Penev L (2018) Species 2000 & ITIS Catalogue of Life, 2018 Annual Checklist. <http://www.catalogueoflife.org/annual-checklist/2018>
- Roskov Y, Ower G, Orrell T, Nicolson D, Bailly N, Kirk P, Bourgoin T, DeWalt RE, Decock W, Nieukerken E van, Zarucchi J, Penev L (2019) Species 2000 & ITIS Catalogue of Life, 20<sup>th</sup> February 2019. <http://www.catalogueoflife.org/col>.
- Savenkov N, Šulcs I (2010) Latvian Lepidoptera Catalogue. Estonian Lepidopterists' Society, 176 pp.
- Schintlmeister A (2013) Notodontidae & Oenosandridae (Lepidoptera). Brill, Leiden, World Catalogue of Insects 11: 608 pp. <https://doi.org/10.1163/9789004259188>
- Schodde R, Bock WJ (2016) Conflict resolution of grammar and gender for avian species-group names under Article 31.2.2 of the ICZN Code: is gender agreement worth it? Zootaxa 4127: 161–170. <https://doi.org/10.11646/zootaxa.4127.1.9>
- Schodde R, Bock WJ (2017) Interpreting Article 31.2.2 of the Code, *Tanagra bresilia* Linnaeus, and gender agreement—a response to Dickinson et al. (2017) towards more positive outcomes. Bulletin of the British Ornithologists' Club 37: 145–150. <https://doi.org/10.25226/bboc.v137i2.2017.a10>
- Scoble MJ (Ed.) (1999) Geometrid moths of the world : a catalogue : (Lepidoptera, Geometridae), 2 volumes. CSIRO & Apollo Books, Collingwood, VIC, Stenstrup, Denmark. <https://doi.org/10.1071/9780643101050>
- Sinev SY (2002) World catalogue of cosmopterigid moths (Lepidoptera: Cosmopterigidae). Katalog roskoshnykh uzkokrylykh molej (Lepidoptera: Cosmopterigidae) mirovoj fauny. Trudy Zoologicheskogo Instituta 293: 1–183.
- Sinev SY (Ed.) (2008) Katalog cheshuekrylykh (Lepidoptera) Rossii. Catalogue of the Lepidoptera of Russia. KMK Scientific Press, St. Petersburg, Moscow, 421 pp.
- Sinev SY (2014) World catalogue of blastobasid moths (Lepidoptera: Blastobasidae). Katalog serykh molej (Lepidoptera: Blastobasidae) mirovoj fauny. ZIN-RAS, Sankt-Peterburg, 108 pp.

- Sinev SY (2015) World catalogue of bright-legged moths (Lepidoptera: Stathmopodidae). Katalog pestro-nogikh molej (Lepidoptera: Stathmopodidae) mirovoj fauny. ZIN-RAS, Sankt-Peterburg, 84 pp.
- Sobczyk T (2011) Psychidae (Lepidoptera). Brill, Leiden, World Catalogue of Insects 10: 1–467. <http://book-andjournals.brillonline.com/content/books/9789004261044>
- Sommerer M (2002) To agree or not to agree - the question of gender agreement in the International Code of Zoological Nomenclature. *Nota lepidopterologica* 25: 191–204. <http://biodiversitylibrary.org/page/41371966>.
- SwissLepTeam (2010) Die Schmetterlinge (Lepidoptera) der Schweiz: eine kommentierte, systematisch-faunistisch Liste. Centre Suisse de Cartographie de la Faune (CSCF) & Schweizerische Entomologische Gesellschaft, Neuchâtel, *Fauna Helvetica* 25: 350 pp.
- Vári L, Kroon DM, Krüger M (2002) Classification and checklist of the species of Lepidoptera recorded in Southern Africa. Simple Solutions, Chatswood, Australia, xxi, 384 pp.
- Vives Moreno A (2014) Catálogo sistemático y sinónimo de los Lepidoptera de la Península Ibérica. de Ceuta, de Melilla y de las Islas Azores, Baleares, Canarias, Madeira y Salvajes (Insecta: Lepidoptera). SHILAP, Madrid, Suplemento de SHILAP Revista de lepidopterología: 1184 pp.
- Welter-Schultes FW (2012) Guidelines for the capture and management of digital zoological names information. 2013–03 ed. Global Biodiversity Information Facility, Copenhagen, 121 pp. <http://www.gbif.org/document/80625>
- Wiemers M, Balletto E, Dincă V, Fric ZF, Lamas G, Lukhtanov V, Munguira ML, Swaay CAM van, Vila R, Vliegenthart A, Wahlberg N, Verovnik R (2018) An updated checklist of the European Butterflies (Lepidoptera, Papilionoidea). *ZooKeys* 811: 9–45. <https://doi.org/10.3897/zookeys.811.28712>
- Yakovlev RV (2011) Catalogue of the Family Cossidae of the Old World. *Neue Entomologische Nachrichten* 66: 1–129. [https://www.zobodat.at/pdf/Neue-Entomologische-Nachrichten\\_66\\_0001-0129.pdf](https://www.zobodat.at/pdf/Neue-Entomologische-Nachrichten_66_0001-0129.pdf)